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ABSTRACT

The members of the Association for the Development of Computer-Based Instructional Systems (ADCIS) are neither computer fanatics nor are they predominately members of any one profession; rather, they are a group of devoted humanitarians who are committed to finding realistic educational and training alternatives which (1) recognize individual differences, (2) do not confuse organizational discipline with instruction, and (3) are concerned with providing the appropriate instructional experience for everyone who wants to learn. The high priority issues ADCIS members must face are: (1) defining the most significant educational and training problems to be solved, (2) finding creative and logically superior solutions to those problems, and (3) comparing the outcomes of alternative solutions in a valid and persuasive manner. Unfortunately there is little progress being made in the first and third areas. ADCIS has the potential to help strengthen communication and the sharing of ideas; and it can help members assume a more scientific and objective posture, as well as formally encouraging research in priority areas in various ways. (VT)

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THE ART OF SCIENCE: PROFESSIONALISM IN CBI

by

Michael W. Allen

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THE ART OF SCIENCE: Professionalism in CBI

(or Standing on Each Other's Feet)

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I have an incredible sense of respect for this group and the 20th Century phenomenon of ADCIS. Rarely has any group faced the level of challenge the members of this organization eagerly welcome and tackle daily. Moreover, the challenge is met by each of us, individually and sometimes collectively, with a conviction and a deep inner knowledge that what we propose and strive for is right. The consequences of reaching our goals will be so far reaching that they cannot be described by anything less than a social and technological revolution.

ADCIS is not an assembly of computer freaks nor is it an assembly of teachers, professors, deans, superintendents, training directors, general managers, doctors, or musicians; but certainly there are many of these in our ranks. ADCIS is not a homogenious group in any sense, except one: we are

a group of devoted humanitarians who are, on one hand, enraged about current educational practices, and on the other hand, committed to finding realistic educational and training alternatives--alternative approaches which recognize individual differences: needs, abilities, aspirations, hopes, motivations, etc. -- alternative approaches which do not confuse organizational discipline with instruction -- alternative approaches which are not so concerned with selection of a top notch, blue ribbon student population as they are with finding and providing the appropriate instructional experience for everyone who wants to learn.

Each of us has ideas, important ideas, on how to provide appropriate instructional experiences and on the relative importance of various technologies in providing them. Because of the history and name of this organization, it is also safe to say that many of us feel the computer is important in reaching our goals. We do, indeed, find amoung us very many different ideas on what role the computer can and should play in educational efforts. And it is the volume and variance in these ideas which makes the future hopeful and us, as professionals, potent. It gives us energy and causes us to repetitively reaffirm the soundness of our postulates and assumptions. It keeps us honest.

My concern today is that we may be becoming insensitive to too many questions; perhaps because there so many of us and we find confidence in our numbers. Or we may have turned our attention from primary issues to those of more personal or theoretical interest. We may be attempting to answer the question, "how can computers be used in education?" The answer to which is "many ways". We even have rather lengthy dichotomies and categorizations of the ways. People already speak of traditional! CAI--referring to the usual way of styling computer-assisted instruction lessons (without a very highly level of adaptiveness and with a lot of "page turning").

It may appear I'm suggesting that theoretical exploration is not important and neither is applied research... to which you respond "what's left?"

I'm not suggesting either of those things. Theoretical and applied research are not just important, they're vital. But, in my opinion, the high priority issues ADCIS members must face are:

1. defining the most significant educational and training problems to be solved

2. finding creative and logically superior solutions to those problems

3. comparing the outcomes of alternative solutions in a valid and persuasive manner

I'm developing a strong and nagging opinion that we're making little progess in the 1st and 3rd areas... not that no progress is being made and also not that more effective efforts can't be made in the second area. We tend, however, to focus the majority of our efforts on the solutions...we have beautiful solutions; if only they were applicable to our most serious concerns.

Note that I did not include in my list the item:

determining how effective the computer can be in solving the identified problems

Although we have a special interest in computer solutions, it's not beneficial, not even to that interest, to overlook non-computer based media. We must be open to all alternatives, actively seeking and comparing alternative solutions.

1. defining the most significant educational and training problems to be solved

We all face the temptation to put high in our priority lists those problems which are most easily solved or are most interesting to solve, instead of carefully analyzing needs, defining specifically and operationally the problems and their origins, and prioritizing according to impact of the problem and value of the solution.

The needs lie in both theoretical and applied areas. They lie in areas of cost. They lie in areas of social responsibility. They lie in managing instructional institutions; in acquainting the public with the notion that mastery is better than grades, that learning is a life-long activity, that learning can be enjoyable, and that everyone can learn; and in training and retraining teachers.

Although the majority of CBI efforts focus on the delivery of individualized instruction, delivery mechanisms have evolved far more than have effective means of adaptive curriculum design. Some well worked adaptive models have been advanced, but finding affordable methods of curriculum development utilizing those models seem to be a formidable challenge.

We speak of easy-to-learn authoring languages. But I have to ask, easy to learn to do what? Few adaptive models are simple. We therefore require authoring languages which make highly complex logic easy to articulate. It doesn't matter if it's easy to program simple, superfluous things if it requires great expertise to carry out valuable operations.

I don't want to belabor this, because it's only an example of my point; but the computer must be considered one of a host of alternative media. If the instructional model is simple and also effective, it may very well be that it need not be computer-based for delivery. It bothers me very much to see CBI systems being used for rather trivial functions and then (and therefore) being judged too expensive by many. Used not as a novel supplement but in situations where CBI calculatedly and effectively provides a vital service, the costs look quite different. Cost effectiveness can be achieved by design--but rarely by accident...and this brings me back to my current point: it all lies in a careful definition and selection of the problems to be solved; if the problems being addressed are insignificant, the solutions to those problems will yield insignificant benefits.

2. finding creative and logically superior solutions to those problems

Much has been done to develop computer-based resources for education and training. In the last two years I have seen truly amazing work done in both expanding the capabilities of interactive systems and in reducing the level of expertise required to implement adaptive courseware. In my own work, we have written graphic display editors which give full editing control over the most complex displays to people with as little as 1/2 hour experience with the system. We have made it possible for people with typing ability, but no knowledge of interactive computing nor of computer programming, to control tailored diagnostic testing, to arrange for sophisticated prescription generation, and to analyze the comparative effectiveness of on- and off-line instructional materials.

We have seen the successful introduction of home computers just this winter. Costs of processors and display units have dropped so significantly that hundreds of thousands of hobbyists can afford CRT displays--even while many CBI operations are still struggling to make the shift from slow teletypewriter terminals to faster and quieter display units.

Similarly, in an area of great cost concern, we are seeing major advancements in communications capabilities such that one telephone line can service many more terminals than it previously could. This is being achieved through shared processing--with the terminal taking an increasing share of the load--and through improved multiplexing configurations. It's not difficult to project 100 or more terminals sharing the same line while providing extremely fast response time, access to large databases, and effective distribution of current courseware.

But have we made similar advances in <u>educational</u> technology as we have in software and hardware technologies?

Advanced computer capabilities haven't reduced the intellectual effort required to construct and test instructional models (although it has dramatically reduced the time of implementing and evaluating them). They haven't made it easy to design accurate diagnostic testing nor to deal with learning disabilities. They haven't alleviated the need for artistry and creativity in the preparation of effective and motivating instructional experiences. They haven't solved, as a matter of fact, very many of the toughest problems we face... but they have, perhaps for the first time, made it

possible to make systematic progress toward the solution of some of society's most devastating inadequacies.

We're not in an easy business. And in one sense, it's not getting any easier...the broadening capabilities of our systems give us more and more opportunities. With more opportunities, it is increasingly important not to exhaustively try all possibilities. Adhering to the methods of science--advancing theories and using them as a basis for research--will undoubtedly prove a more effective strategy than random hit and miss development and evaluation. In devising solutions, we must moderate our interests in novelties and commit to solving the real--the tough--problems.

3. comparing the outcomes of alternative solutions in a valid and persuasive manner

Because the realm of possibilities is continuously and rapidly broadening, it's difficult to carefully and exhaustively test any instructional model at the sacrifice of moving on to the exploration of new potentials. As Editor of the JOURNAL of COMPUTER-BASED INSTRUCTION, it is my privilege to peruse many reports of on-going CBI activities. I have become concerned, however, at the volume of manuscripts which do not test a theoretical model, which do

not seriously attempt to compare two or more procedures, and which do not even recognize current literature. These papers (while often of value) are actually reporting that some development was done because the developers found it personally challenging and possible within the confines of their hardware and software.

We know that CBI is exciting and often rewards ingenuity in observable hardware functions and user amazement. We even know that in many cases CBI has been effective in stimulating learning and has produced positive student attitudes. The questions we face are not: can the computer teach? can the computer simulate human instruction? The questions are what makes one instructional approach more effective for an individual than another?, how can we predict which approach will be most effective?, and what are the most efficient delivery media for the most effective approaches?

The replication of experiments is important to determine the stability and generality of findings, but the value of replication is scant without careful delineation of equivalencies and differences in the experimental and control variables. It appears that communication among us is so poor that writers are often unaware of related works and write as though their studies were pioneering efforts.

The Potential of ADCIS

It may well be that other professions and disciplines may be characterized similarly, but I honestly feel ours is unparalleled in aspiration and dedication on one hand and informality and lack of rigor on the other. ADCIS legitimately represents more of application than theoretical research and is much concerned with development, but technology is not separate from science--it is part of it--professing the same methods of objective investigation and serving to provide vital feedback for theoretical research validation and direction (see Schaffarzick and Hampson, 1975).

Whether there is (or can be) a science of teaching is a wonderful debate; but whatever the answer, there is most definitely an art to science. Some scientists are more successful than others, more published than others, more respected than others, and so on. Some have more funding opportunities than they can handle, others with at least equal research prowess and perhaps greater insight cannot get minimal recognition. There is obvious truth to the statement that knowing the right people helps. Having the respect of colleagues (even just having them aware of your

work) and publishing are definite benefits.

ADCIS as an organization is helpful in many ways to everyone in the field. It gives us an opportunity to develop individually the art of being professionals--technicians--scientists. It helps draw attention to our collective efforts to advance the technology. ADCIS has responded rapidly and effectively to requests for special professional support, both monetarily and professionally. It has taken on the heavy burden of publishing the JOURNAL OF COMPUTER-BASED INSTRUCTION (JCBI), supported the Health Education Network Users Group, and underwritten partial costs of producing the INDEX TO COMPUTERIZED TEACHING IN THE HEALTH SCIENCES, as examples. And ADCIS has much more to offer.

Let me reiterate the three issues I've discussed to see how we might use our organization to further efforts in those areas:

1. With respect to defining the most important problems to be solved and challenges to be met, no single list nor prioritization of items seems either realistic or desirable; but ADCIS has divisions based on special interests and/or target student populations: Health Sciences, Elementary-

Secondary-Jr. College, Minicomputer Users, PLATO Users, Health Education Network Users, Music Instruction, and Education of the Deaf. I'd like to see these divisions work out within themselves the highest priority problems they face and questions they need to have answered.

2. With respect to discovering creative and effective solutions or methods for discovering such solutions, ADCIS could establish an "Outstanding Researcher" award and organize an appropriate selection committee. The committee could serve to single out those individuals who have not only successfully leveled their efforts at significant problems, but have also recognized and built on the work of others and have communicated the results of their investigations in a professional manner for the benefit of the CBI community. Hopefully such awards would encourage emulation of the professional attitude and establish a trend toward increased value of all CBI investigations.

We have many among us who are indeed worthy of such an award. Recognition of their efforts would most certainly prove beneficial to the continuation of their work as well as help broaden the impact of their studies. As a function of these awards, we might also hope for increased awareness of ADCIS as an organization and broadened recognition of its purpose and function as a professional society.

3. Finally, with respect to the need for comparing outcomes of alternative instructional treatments, let me state what most of you are painfully aware of: controlled research in our field is difficult to orchestrate, time consuming, and expensive. Refining experimental designs so that the results will be specific enough to be useful and yet general enough to be broadly applicable can be very costly, but not having such data is very costly as well.

ADCIS could formally encourage research in priority areas, if not by direct funding, then perhaps, by serving as a catalyst for the formation of consortia (this has already happened once--the Health Education Network Users' group was formed for just such a function), by requesting that research grant proposals be written on the vital topics and then serving to facilitate their funding, by holding workshops in which multi-institution experiments and research projects are designed, by publishing special JCBI issues on the topics, etc.

There is an art to the career of a scientist. It involves experimentation, writing research reports, preparing grant proposals, and an objective attitude. Membership in key

professional organizations can provide important benefits. I'd like ADCIS to be the most important organization for people in the field of computer-based instruction. We need ADCIS and ADCIS can serve us in powerful ways.

ADCIS can help strengthen communication and sharing of ideas. It can help us assume a more scientific and objective posture. The need is real and urgent. I am not suggesting that systematic investigation should or can substitute for enthusiastic insight and creative exploration; but I do think we need to make sure we are taking every step possible to ensure the value of each exploratory effort.

Prof. Bruce Sherwood, a physicist and prominent CBI investigator with whom it is my honor to be friend and colleague, stated the situation aptly when he said, "In physics we stand on the shoulders of such giants as Galileo, Newton, and Einstein; in CBI we're standing on each other's feet!" I think not only can we get off each other's toes, but we can also march effectively against many of the enemies of effective humanistic adaptive instruction by strengthening our Association and by developing our science arts.

REFERENCE

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